

### → A EUROPEAN RESPONSE

ESA and its Member States have developed the Climate Change Initiative to help address issues related to our changing world. Through this dedicated programme, robust, long-term, global satellite datasets are produced.

These data are required by the Global Climate Observing System (GCOS) to support the United Nations Framework Convention on Climate Change (UNFCCC) and the International Panel on Climate Change (IPCC).

Archived satellite data from ESA, Member States and Third Party Missions going back three decades and more are combined with new data to generate information on a wide range of climate variables such as greenhouse-gas concentrations, sea-ice extent and thickness, sea-surface temperature and sea-level rise, to name but a few.

The Climate Change Initiative provides the science community and governing bodies with vital Earth observation datasets to understand and help mitigate climate change. All data products are freely available, along with supporting information about how they were defined, created and tested.

Global data for global problems



Satellites observing Earth from space provide a clear picture of the health of our planet and the signs of climate change. The need for sustained global observations has long been recognised by the UNFCCC, and articulated in terms of requirements for 'Essential Climate Variables' by the Global Climate Observing System.

ESA's Climate Change Initiative makes full use of Europe's Earth observation space assets, including the Copernicus Sentinel missions as they become available. Through this coordinated programme, long-term datasets on key indicators of climate change are being systematically generated and preserved. These Essential Climate Variables provide Europe with a powerful tool to monitor the state of the climate system and to help predict the effects that a changing climate may bring.

[www.esa.int](http://www.esa.int)

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climate change initiative

## → UNDERSTANDING CLIMATE CHANGE FROM SPACE



“Scientific evidence for warming of the climate system is unequivocal”

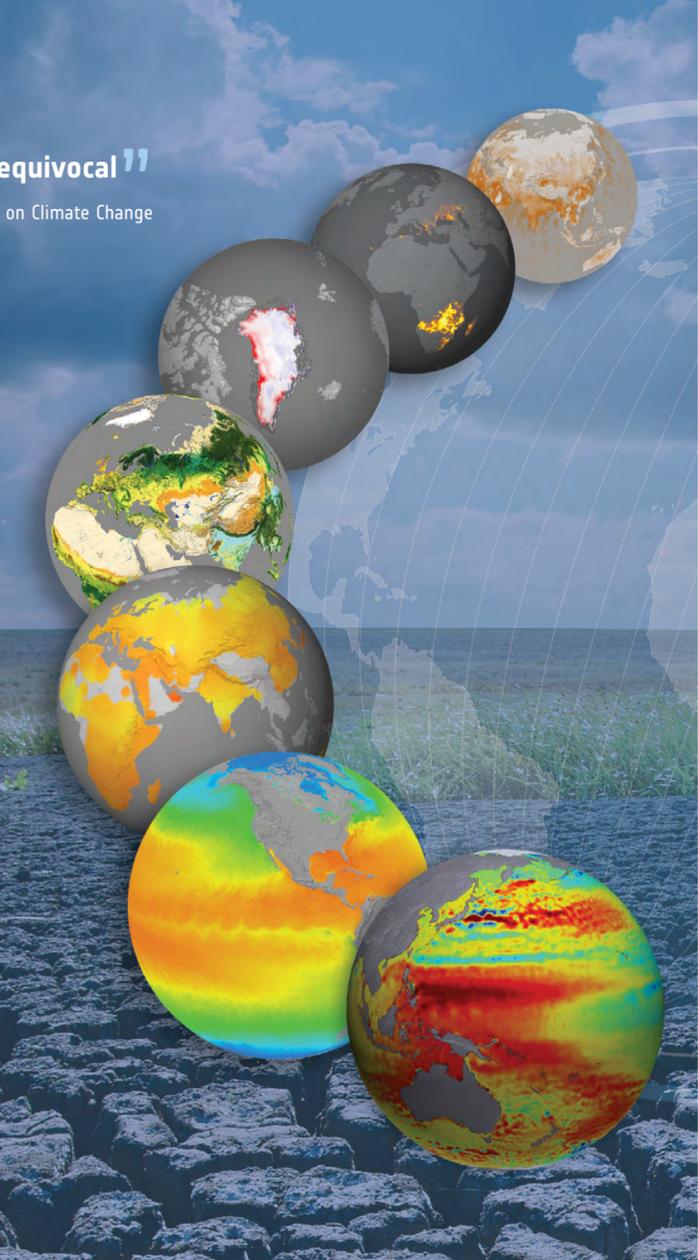
Intergovernmental Panel on Climate Change

### → A GLOBAL CHALLENGE

The rate at which global climate change is happening is arguably the most pressing environmental challenge we face today. The consequences of a warming climate are far-reaching, potentially affecting fresh water resources, global food production and sea level, and triggering an increase in extreme-weather events. Threatening radical impacts on the natural environment and life on Earth for generations to come, climate change is high on political, strategic and economic agendas worldwide.

Earth's climate has always varied naturally, so separating natural variability from changes induced by human activity is important for confronting today's challenges. Datasets provided by satellites observing Earth are crucial for measuring key parameters of climate change: 'Essential Climate Variables'.

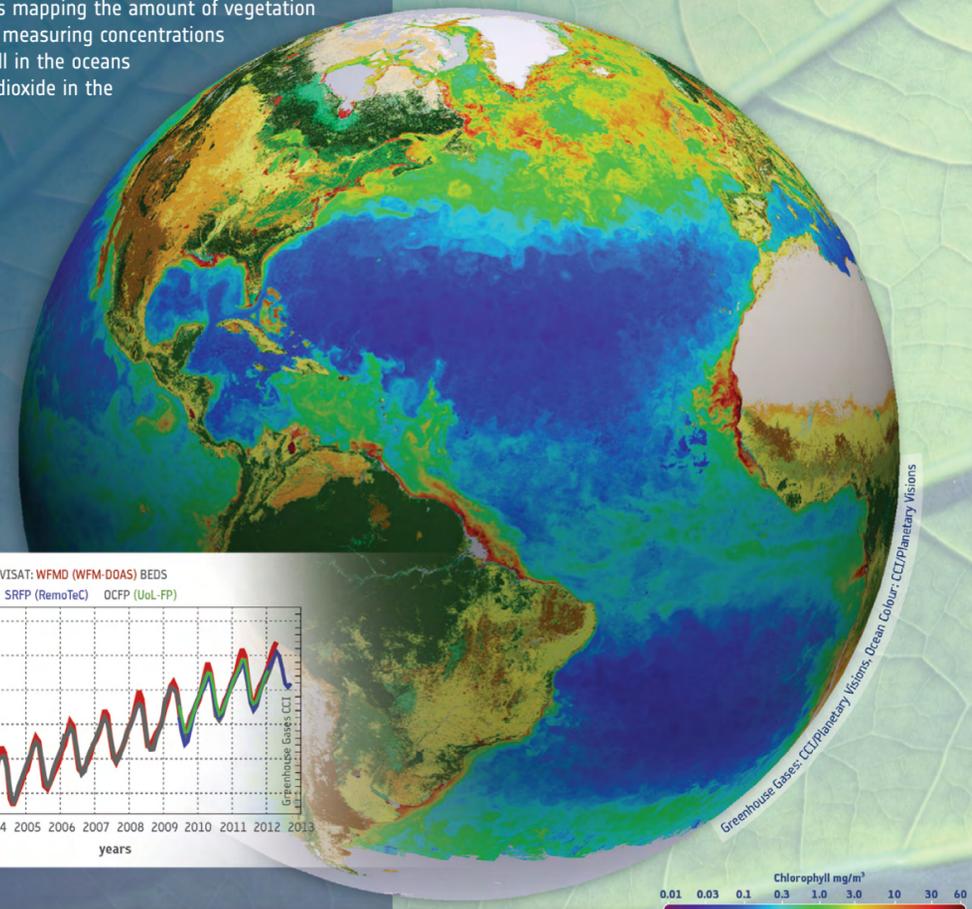
Using satellites to observe Earth is the only way of providing the scientific community with the data they need to improve our understanding of the Earth system and help predict future change. In turn, these data also form the basis for policy-makers to build the most effective strategies for adapting to and mitigating the effects of a changing climate.



## → COUNTING CARBON

ESA's Climate Change Initiative is helping to ensure the long-term generation of data on climate variables for more accurate carbon modelling.

This includes mapping the amount of vegetation on land and measuring concentrations of chlorophyll in the oceans and carbon dioxide in the atmosphere.



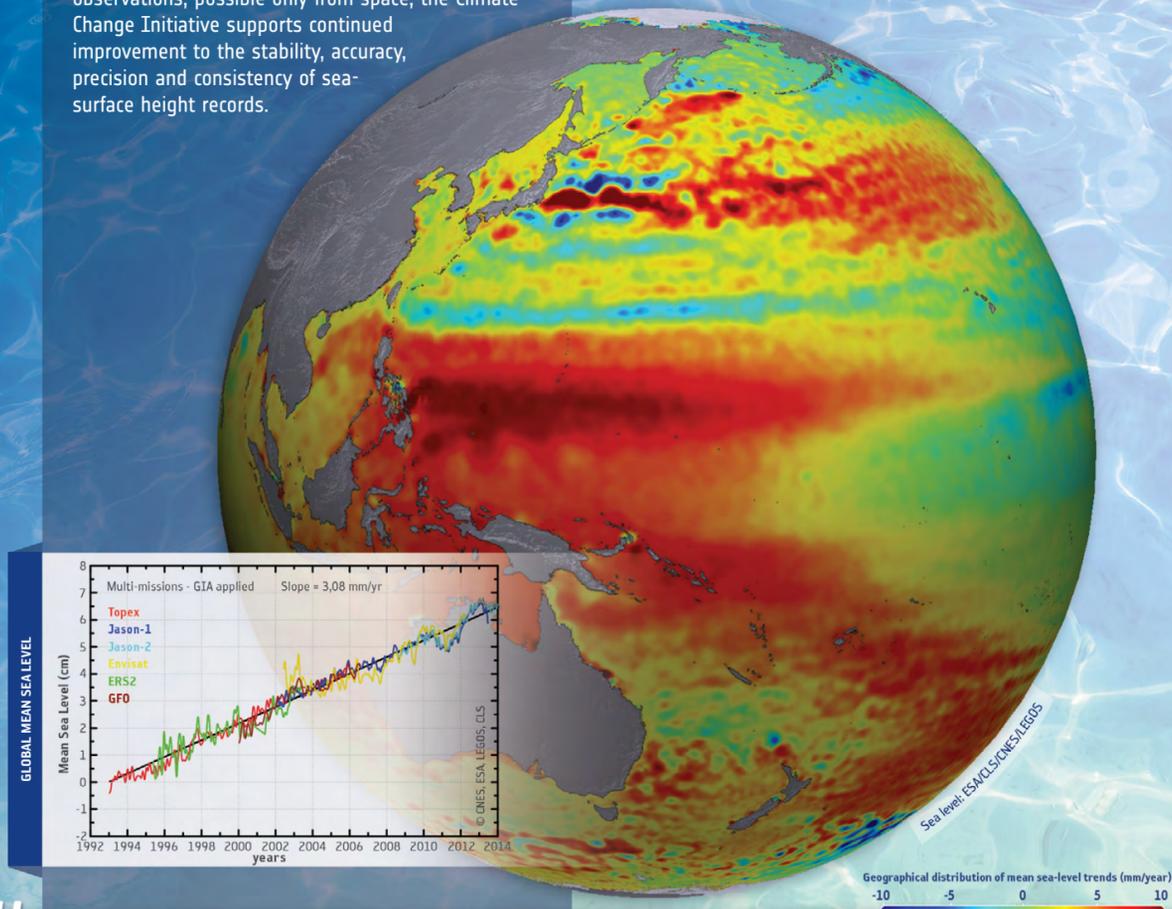
ATMOSPHERIC CARBON DIOXIDE  
NORTHERN HEMISPHERE

Carbon dioxide concentrations have increased by 40% since pre-industrial times, mainly from fossil-fuel emissions and net land-use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification.

CLIMATE CHANGE 2013 – The Physical Science Basis IPCC

## → AN OCEAN OF CHANGE

Change in sea level is considered to be a primary indicator of global climate change. Building on the most accurate and best calibrated long-term observations, possible only from space, the Climate Change Initiative supports continued improvement to the stability, accuracy, precision and consistency of sea-surface height records.



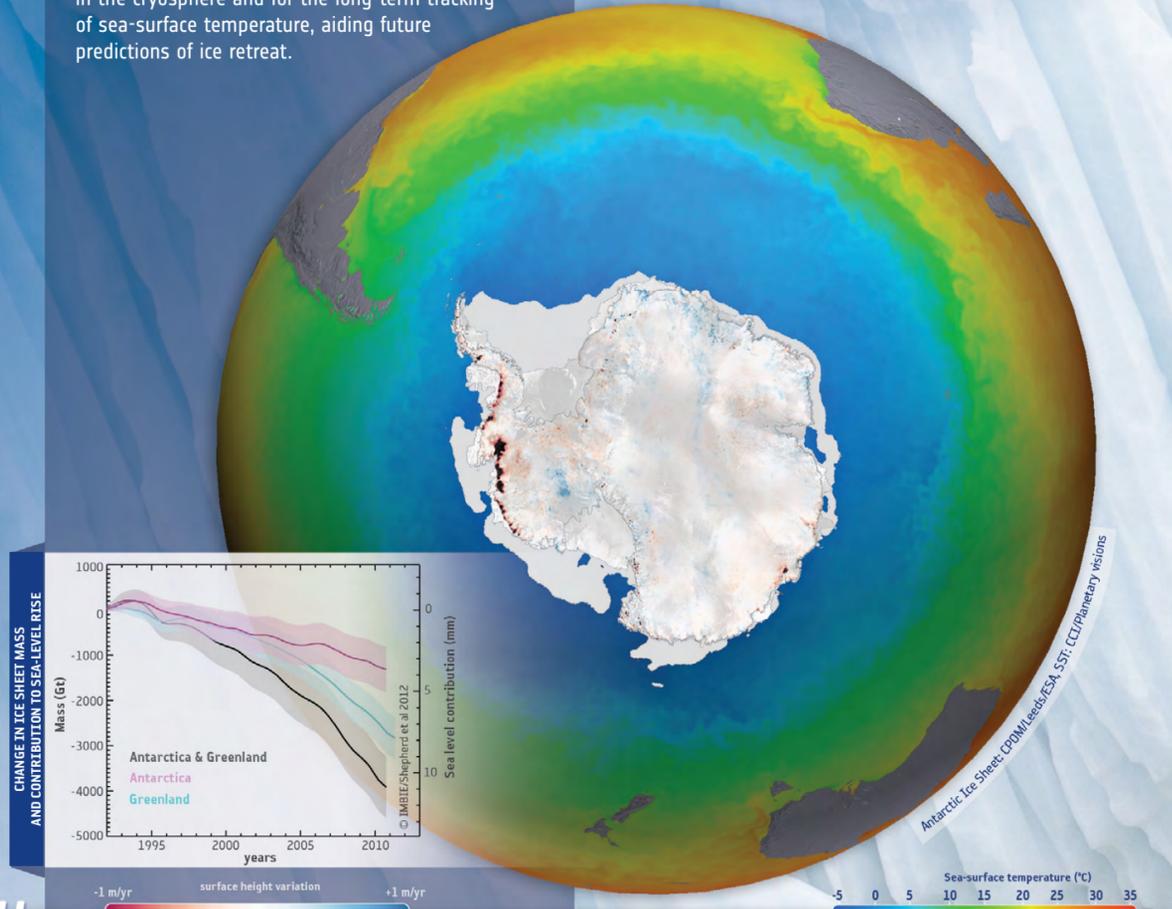
GLOBAL MEAN SEA LEVEL

The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19 (0.17 to 0.21) m.

CLIMATE CHANGE 2013 – The Physical Science Basis IPCC

## → ICE RETREAT

The polar regions play an important role in global ocean circulation. Satellite data used in the Climate Change Initiative are vital for monitoring rapid changes in the cryosphere and for the long-term tracking of sea-surface temperature, aiding future predictions of ice retreat.



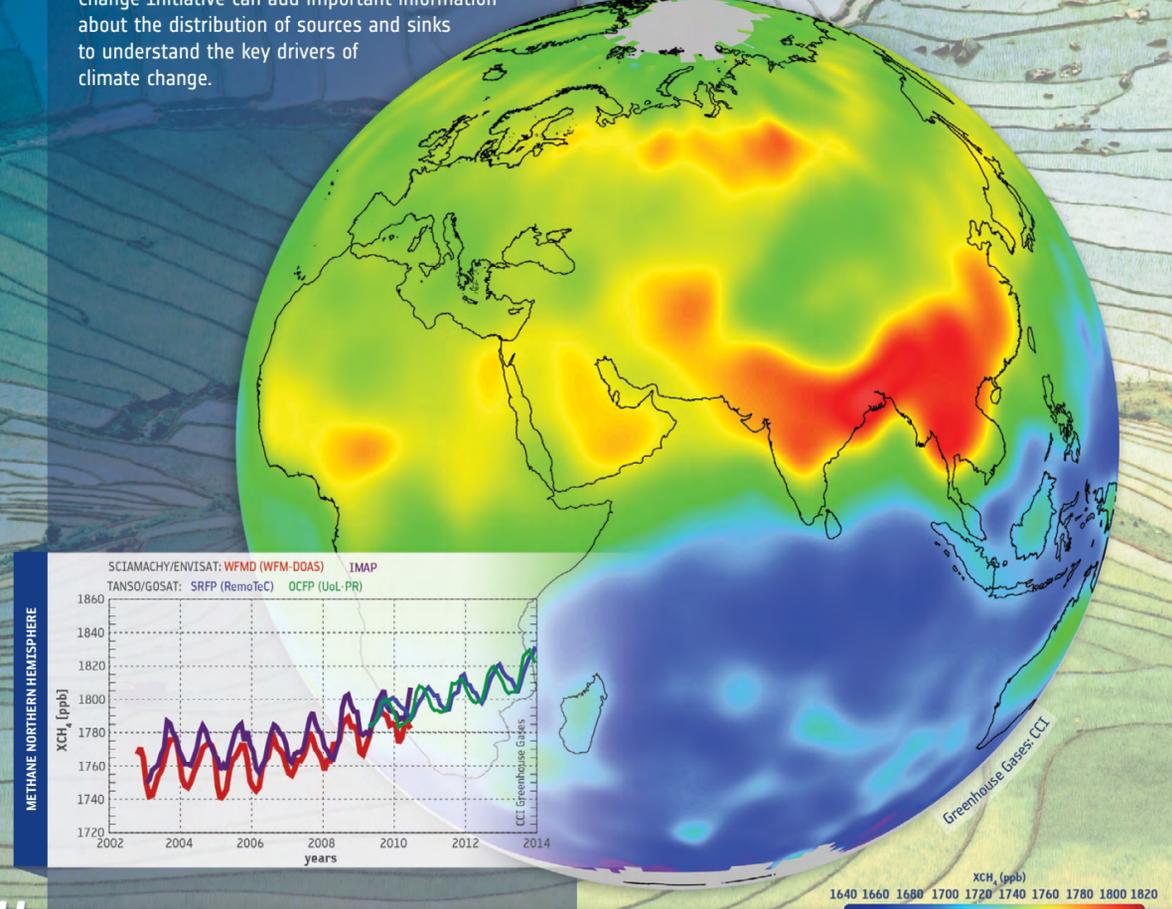
CHANGE IN ICE SHEET MASS  
AND CONTRIBUTION TO SEA-LEVEL RISE

It is virtually certain that the upper ocean (0–700 m) warmed from 1971 to 2010, while over the last two decades, the Greenland and Antarctic ice sheets have been losing mass and glaciers have continued to shrink almost worldwide.

CLIMATE CHANGE 2013 – The Physical Science Basis IPCC

## → MAPPING METHANE

Atmospheric methane is a potent greenhouse gas and concentrations have more than doubled since pre-industrial times. Data provided through the Climate Change Initiative can add important information about the distribution of sources and sinks to understand the key drivers of climate change.



METHANE NORTHERN HEMISPHERE

The mean rate of increase in atmospheric concentrations (of methane) over the past century are, with very high confidence, unprecedented in the last 22000 years.

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